

What's the difference between an explosion and a detonation?

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For over 75 years, Los Alamos scientists have been intimately involved with explosives and detonators and the relationships between their chemical compounds and performance. In fact, without the spherical shock wave created by Fat Man's detonating lenses, the Manhattan Project may have turned out very differently, indeed.

Discovered in 1881 by French scientists, detonation is the result of a supersonic wave initiating a secondary explosion. Created by the primary initiation of a small amount of high explosives using friction, spark, flame, impact or electromagnetic radiation, this resulting shock front is powerful enough to launch a secondary explosion in relatively less-sensitive explosive materials like Trinitrotoluene (TNT). The initiator for this process, or detonator, is most often electrical or mechanical in nature but chemical versions aren't uncommon. Used primarily for explosives and munitions, or "pushing metal," detonation waves also have less destructive purposes including depositing coatings and welding together metals that may otherwise fail to bond.

Explosion, on the other hand, is a general term for an accelerated release of energy generating extreme temperatures, releasing of gases and expanding volume.

Explosions may be supersonic as in the case with detonations using high explosives like Pentaerythritol tetranitrate (PETN) or subsonic and initiated by deflagration (combusting materials via heat transfer) of low explosives like gun powder, as seen in fireworks or Hollywood pyrotechnics.

Explosions also occur naturally in volcanic events, supernovas, and even brushfires resulting from volatile chemicals in some eucalyptus forests suddenly igniting.

Alternatively, most detonations result from intentional human activities, though lightning has been known to set off electric detonators and can pose a serious threat to workers in mining blast sites.

By leading innovation in novel detonator design, Daniel Preston and staff from the Lab's Detonation Science and Technology Group ensure that the nation's weapons stockpile remains agile and modern and that detonation systems for them work as expected, when expected, and remain safe.

Occasionally questions are sent in to edu-bsm@lanl.gov or are left in our feedback box in the Museum.

We work to provide answers to these questions on [our blog](#) and the site where we list our [favorite questions and answers](#).

1350 Central Avenue
Los Alamos, NM 87545



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(505) 667-4444
www.lanl.gov/museum

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